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The Bull-dog Calf: A Contribution to the Study of Achondroplasia.*

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The condition of achondroplasia has long been known to human obstetricians and pathologists. As early as 1817, Romberg had described a human fœtus with remarkably short limbs; others were recorded by Chaussier (1819), Weber (1829), Busch (1836) and Dumenil (1856). These writers, though satisfied that the condition which they were describing was not rickets, hesitated to give it a name. Virchow, in 1856, described another case and definitely diagnosed rickets, and by so doing attracted the attention of the medical profession to the condition. Winkler (1871) suggested the name rachitis micromelia, in order to call attention to the outstanding peculiarity of this supposed variety of rickets, namely, the remarkable shortness of the limbs. In 1876 Parrot described the condition as a discrete form of disease of human fœtuses, distinguishable from rickets and from congenital syphilis, and gave to it the name achondroplasia. The characteristic features of achondroplasia, according to Parrot, were: (1) micromelia; (2) abnormal shape of the cranium; (3) absence of thoracic deformity; and (4) marked thickening of the skin.

In spite of Parrot's writings, the condition was generally regarded as either rachitic or syphilitic in nature until Porak confirmed and extended Parrot's conclusions. He showed that the condition was hereditary, that it occurred among animals other than man, and that it had existed from very early times. Kaufmann (1893) described fourteen cases, and suggested the name chondrodystrophia fœtalis. The name achondroplasia has the advantage of priority, and custom sanctioned its adoption, but that suggested by Kaufmann is the more descriptively accurate. Up to 1900 only achondroplasic fœtuses had been studied; in that year Marie described the condition as exhibited by the living adult. Apert (1901-2) and Méry and Labbé (1902) described further cases and distinguished between achondroplasia, cretinism, and myxœdema. Durante (1902) described two distinct forms: true achondroplasia and periosteal dysplasia. But even now the group-name achondroplasia accommodates a considerable number of pathological conditions which may or may not be different modes of expression of a polymorphic disease. Such very different conditions have been described as micromelia, chondritis fœtalis, osteogenesis imperfecta, pseudo-chondritis, cretinoid dysplasia, micromelia chondromalacica, osteoporosis, periosteal aplasia, and chondrodystrophia fœtalis with its three varieties: hyperplastica, hypoplastica, and malacica. In this paper achondroplasia is referred to as a group name.

The human achondroplast presents the characteristic features of the condition. The trunk is shortened in some cases; the limbs are short and thick and distinctly curved, with the convexity outwards. The head is larger than usual, with bulging forehead and parietal eminences; the bridge of the nose is depressed. The skin is thick and wrinkled. The foot is rotated inwards, the vertebral column straight, and the back flat, though the buttocks and abdomen are prominent. The condition is reminiscent of the earlier fœtal proportions, the limbs being short in relation to the trunk. Another persistent fœtal character is the *main en trident* (or "bident"), the second and third metacarpals forming an angle of about 40° with one another, instead of the usual 32°. In the newly-formed fœtal hand the metacarpals form an angle of ± 90°, so that the digits are widely separated. This divergence diminishes during the course of further development, but less in the case of the achondroplast than in the normal. Still another fœtal condition is mirrored in the achondroplast pelvis, which is smaller than the normal.

The great majority of achondroplasts are stillborn, but a few survive to become robust muscular adults. The adult is of low stature and of great muscular development; he or she has a normal-sized trunk, a large head, short limbs of the rhizomelic type—the proximal segments being more shortened than the distal—thick short hands and feet, and spread digits when extended. The shortness of the limbs is not due to any crookedness or bending of the bones, as in rickets or osteomalacia, nor is it the result of multiple fractures, as in osteogenesis imperfecta, nor of the congenital absence of any bone: all the usual bones are present but they are much shorter than normally.

Achondroplasia in the human is a hereditary disease. An achondroplasic race cannot exist because an achondroplasic woman cannot come to a normal confinement, and in the absence of surgical interference both mother and child must perish. Cæsarean

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section is necessary in order to save both, and craniotomy must be carried out if the mother alone is to be saved. Micromelia and foreshortening of the facial region, however, are familiar characteristics, and they may be regarded as low grades of the condition of achondroplasia. In different cases a human achondroplast has had an achondroplasic father, mother, brother(s), sister(s), grandfather; father and brothers and sons, an achondroplasic co-twin, a normal co-twin. An achondroplasic parent of either sex married to a normal mate may have normal children. Rischbeith gives a long series of such cases. It is of interest to note that Catherine de Medici, Natalie, sister of Peter the Great, and the Empress Ann of Russia, tried without success to raise a race of these dwarfs by arranging their intermarriages.

In the case of the human, there would seem to exist different grades of this condition. The lowest grade is seen in the case of an adult of low stature whose arms and legs are short in relation to the trunk; the highest grade is that seen in the stillborn fœtus which exhibits several, if not all, of the following characters: Shortened limbs and base of skull, depressed nose, hare-lip, abnormality of the hard palate, narrowed foramen magnum, umbilical hernia,anasarca, hydramnios, prominent abdomen, thickened skin, abundant subcutaneous fat, apparent lordosis, brachycephaly, turned-in feet, *main en trident*, shortened vertebral column.

The pathology of achondroplasia has been described in detail by Emerson, Murk Jansen, Keith, Shattock, Sartorius and others. The condition is not one of arrest of cartilage formation, it is one of arrest of bone formation in cartilage. The parts in the posterior fossa of the skull are arrested in their growth, there is considerable contraction of the foramen, and a great shortening of the basi-occipital and basi-sphenoid, followed by a contraction of the naso-pharyngeal space. The ossification of the pre-sphenoid is also arrested and the distance of the pituitary fossa from the fronto-ethmoid junction is greatly reduced. The limbs show the condition of micromelia, the humerus and femur are affected more than the ulna and tibia, and the site of the lesion is limited to those lines where bone is replacing cartilage.

The Dexter.

The Dexter is a breed of the smallest cattle in Great Britain. Formerly it was indigenous to the south and south-western districts of Ireland, but of late years it has become increasingly popular in England. It is highly valued for its general hardiness and utility, being an economical feeder, an excellent milker, and a ready fattener, of pleasing appearance, and thriving well on the poorest of land. It is used profitably as a cross in the production of "small beef." Its general appearance, as defined in the terms of the standard of excellence laid down in the "Kerry and Dexter Herdbook," is as follows:—

Head short and broad, with great width between the eyes and tapering gracefully towards the muzzle, which should be large with wide distended nostrils. *Eyes* bright, prominent, and of a kind, placid expression. *Neck* short, thick and deep and well set into the shoulders, which, when viewed in front, should be wide, showing thickness through the heart, the breast coming well forward.

Horns: These should be short and moderately thick, springing from the head with an inward and slightly upward curve.

Body: *Shoulders* of medium thickness, full and well filled-in behind; *hips* wide; *quarters* thick and deep, and well sprung, flat and wide across the loins, well ribbed-up straight underline; *udder* well forward and broad behind, with well-placed teats of moderate size; *legs* short (especially from knee to fetlock), strong and well placed under the body, which should be as close to the ground as possible. *Tail* well set on and level with the back.

Skin: The skin should be soft and mellow and handle well; not too thin. *Hair* fine, plentiful and silky.

Coat colour.—Bulls: Whole black or whole red (the two colours being of equal merit); a little white on the organs of generation not to disqualify an animal which answers all other essentials of this standard description. *Cows*: Black or red (the two colours being of equal merit). White on udder and the extension of white on udder slightly along inside of flank or underside of the belly, or white on tassel of tail may be allowed on an animal which answers all other essentials of this standard description.

Weight: *Bulls* should not exceed 900 lb. live weight when in breeding condition. *Cows* should not exceed 800 lb.

In view of that which is to follow, it is desired to call attention to these two characters of the ideal Dexter: brachycephaly and micromelia. Two undesirable characters are encountered occasionally—bad "tail-head," the tail not being terminal, but seeming to take origin farther forward along the back and arching upwards and backwards; and a combination of bent forelegs with inwardly turned hoofs. "Its toes turn in after a peculiar fashion, and it tends to walk over the outer digits, especially in the case of the hind feet."

The history of the Dexter is wrapped up in that of the Kerry, and, like that of almost every breed, is befogged by anecdote and speculation. It is generally accepted that the Dexter is an off-shoot of the Kerry. Legend has it that the first Dexter had its origin in the chance mating of a recumbent Kerry cow and a seal from the sea. Be it as it may, it is certain that the breed has arisen out of the old-fashioned Kerry stock as the result of an outcross. The Dexter differs from the Kerry in that "the leg bones are shorter and more substantial, the neck thicker and shorter, the horns heavier, not so elevated and airy, and the head heavier and not so doe-like as in the case of the original Kerry."

Wilson has given an exhaustive survey of the literature which bears upon the origin of the Dexter breed and upon the manner in which it got its name. He concluded that the early records of the Dexter herd are unreliable, and that a better idea of its ancestry can be derived from the genetical analysis of the modern Dexter.

A statistical study of the results of the mating of Dexter with Dexter show that four classes of calves are produced—black Dexter-type, red Dexter-type, black Kerry-type and red Kerry-type. By Dexter-type is meant a relatively massive head, stout body and limbs; by Kerry-type, a relatively slender head, slim body and long limbs. Of the four classes, the black Dexter-type is by far the most common, the red Kerry-type the least common, while the other two occur in more or less equal numbers. The appearance of four phenotypes in such proportion suggests at once that the Dexter is itself to be regarded as a Mendelian di-hybrid, and that its parental stocks differed one from the other in respect of at least two pairs of contrasted characters, coat colour and bodily conformation. The contrasted characters concerned were: black and red coat colours and Dexter-type and Kerry-type bodily conformations. The old type Kerry—black, slender and long-limbed—could have been one of the parental stocks. If this were the case, then the other must have been a red, stout, short-limbed stock.

Wilson brings forward considerable evidence to show that such an animal was imported into Kerry during the formative period of the Dexter, and that it was crossed with the native Kerry, and sums up the evidence thus: "The probability, therefore, that Dexter cattle descended from Black Kerries and red cattle of the Devon type is very high; and if further proof were wanted, it can be found by setting a red Dexter cow side by side with a red Devon." The modern red Dexter is a mottled red, showing delicate blackish traceries on the red ground; this same mottling is seen in the modern red Devon.

If it is assumed that the original parents of the Dexter were Kerry and Devon, two dominant factors will be introduced, B and S respectively, determining black colour of the coat and short-legged conformation of the body. It is easy to see that the result of black-crossing to either type of parent would give 50 per cent. black Dexter type, while interbreeding between the heterozygous black Dexters would give black Dexter offspring in the proportion of 9 to 16. These Dexters would be of four types, according as to whether they were duplex for both dominant factors (BBSS), simplex for both (BbSs), or duplex for one and simplex for the other (BSSs or BbSS). As soon as the picture of the ideal Dexter took shape in the breeder's mind, the production of a pure strain duplex for both factors followed automatically by the elimination of the red Kerry and the red Dexter off-types.

It is of importance to note that in 1919 the society which was formed in 1917 to promote the interests of Kerry and Dexter cattle breeding in Ireland decided to change its name to "The Kerry Cattle Society of Ireland." This alteration was considered advisable, for herds of pedigree Dexter cattle have practically ceased to exist in Ireland owing to the difficulty of breeding these cattle pure. It is the experience of Irish breeders that when Dexter cows are mated with a Dexter bull, a large proportion of the progeny are either stillborn or deformed. As a result of constant disappointments, owners have gradually given up the attempt at breeding pedigree Dexters, and, so far as Irish breeders are concerned, their whole attention is now directed to the development of the Kerry breed.

Concurrently with the ban upon Dexters in Ireland, a boom was started in England, and to supply the demand for Dexter cattle, the Irish breeders earnestly sought for methods by which Dexter-type calves could be produced and the monstrous calves avoided. The result of their experimentation has been that the Irish Dexter, the so-called "foundation stock" Dexter, is got not by a Dexter×Dexter mating, but by using a Dexter bull and Kerry cows. This mating has never yielded a monstrous calf; it produces on the average equal numbers of good type Dexter and of "sneem" Kerries. The Kerry-type animal so produced is a diminutive Kerry; Sneem is the district of Kerry in which the foundation stock Dexter is raised for export to England, and "sneem" is used locally as a term of reproach, being applied to any undersized creature. The relative numbers of red and of black individuals vary considerably, for it is certain that many Kerries are heterozygous for their black coat colour character. In England the English Kerry and Dexter Cattle Society was founded in 1892, and published its first "Herdbook" in 1900. By the regulations laid down in it, "a cross between the Kerry and the Dexter is considered a half-bred, and cannot be entered." Very soon, as Wilson says, "what was formerly known to Kerry men now became known to other breeders who bred Dexters according to the rules of the 'Herdbook': that such a procedure invariably resulted in the production of a proportion of dead mis-shapen calves."

The Monstrous Calf of the Dexter.

The abnormalities which these stillborn calves exhibit are constant, and are so characteristic that the fœtus is known as a "bull-dog" calf. The cranium is bulging, the nose distinctly depressed, the lower jaw protruding; the upper lip is split, baring the tongue, while the swollen tongue, thrust far out, curls up over the nose. Owing to the disproportionate development of the buttocks, the tail seems to have its origin far up on the back; usually there is a gaping deficiency of the abdominal wall through which the intestines pass to form a large umbilical hernia. The skin hangs loosely in folds, and there is abundant subcutaneous fat. The limbs are ridiculously short and the digits unusually separated.

The period of gestation in the Dexter is approximately 284 days. In the great majority of cases it can be foretold that a pregnancy is to terminate in the production of a "bull-dog" fœtus, for in such cases the pregnant cow begins to increase in size very rapidly about the third or fourth month, and ultimately becomes very distended. The early obliteration of the hollow in the flank just in front of the hip is recognised as a sure sign of impending trouble. Then it is noticed that the cow is losing "water," which dribbles from the vulva, and that she is becoming less and less distended. After a time the loss of

fluid ceases, but after a short interval the cow is as "big" as ever. Again there is the flow of fluid from the vulva and the decrease in size, and again the cycle is repeated. Following one of these discharges of fluid from the vulva the fœtus is aborted. The fluid is described as being clear in the majority of cases; in a few it has been turbid. But, as Seligmann [22] has previously recorded, it is not invariable for a Dexter with a considerable degree of excess of amniotic or allantoic fluid to give birth to a deformed calf. Moreover, the pregnancy which results in the abortion of a dead monstrous calf is not invariably associated with such excess. Extremely rarely, so the breeders say, the first indication of anything abnormal is a premature labour. In such cases the calf is not delivered naturally, it must always be removed by operative procedure, and is dead when delivered. The puerperium following the delivery of the "bull-dog" calf differs from that following the birth of a normal one. The placenta comes away in small fragments, or has to be extracted manually, instead of being thrown off complete in a half to four hours. In fact, herdsmen will state that there is no after-birth in the case of the "bull-dog." The lochia last longer than is usual, the blood-stained discharge persisting in certain cases even as long as a fortnight instead of the usual one to four days. The abortion of a fœtus, other than a "bull-dog," is followed by an immediate cessation of mammary activity; the abortion of a monstrous calf, on the contrary, does not interfere with this, and the cow produces milk.

The normal Dexter calf is a small individual compared with calves of the same age, but of the larger breeds. No specimen of the normal Dexter fœtus has been available for comparison, but an "off-type" (a Kerry type) fœtus was obtained at the eighth month of pregnancy. The bull-dog fœtus of the same age is very much smaller.

Age of bulldog	Weight	Length	Diameter shoulders	Length of foreleg	Length of hindleg
7 months	12lb. 15oz.	28 cm.	44·1 cm.	5·1 cm.	5·7 cm.
7 „	10 „ 3 „	30·5 „	42·6 „	7·3 „	7 „
7 „	11 „ 11 „	30·2 „	39·9 „	6·1 „	5·7 „
4·5 „	6 „ 11 „	17·8 „	30·2 „	6·1 „	6·4 „
3·4 „	3 „ 8 „	20·5 „	17·0 „	3·0 „	6·0 „

An examination of many specimens has shown that there is never any suggestion of putrefaction or of mummification of the fœtus. The abortion quickly follows the death of the calf. The death of the fœtus is associated with severe fœtal anasarca (fœtal dropsy) in the case of the earlier abortions and of the majority of the later ones, and with profound dystocia in the cases which proceed until near term. In practically all cases in which there is hydramnios (or hydrallantois) fœtal anasarca is present; the fœtus is a fluid-logged shapeless mass and the almost complete subcutaneous covering of the abdominal wall is devoid of skin over a circular area based upon the umbilical cord. In the case of the older fœtus death results from dystocia. The prolonged and difficult labour is made inevitable by the shape and consistency of the fœtal head, which cannot be accommodated by the maternal birth passages. The bull-dog fœtus has a head of unusual shape and consistence. The size of the fœtus and the shape of the head are to be regarded as significant features.

As regards the incidence of the monstrous calf, many entries of "premature" or "dead" are to be found in the herdbooks in the column which shows the births during the year. It cannot be expected that such a record is critical. English Dexter breeders, anxious to find a solution of the problem, supplied the following absolutely trustworthy figures:—

Total births	Normal calves	"Bull-dog" calves	Proportion
646	530	116	1 in 5·5

At first sight there appears to be no consistency in the occurrence of the monstrous calf. Some herds are singularly free from them, others yield so many that the breeder is forced to get rid of his stock. A certain cow may produce a series of most excellent Dexter calves and then yield a typical monster to the same sire. Or else, a cow will produce a series of "bull-dogs" to the service of several different bulls, and the next season will produce a prize-winner. There is no animal out of a Dexter×Dexter mating that is not related more or less closely to a monstrous calf; the "bull-dog" appears in all herds in numbers ranging from 5 per cent. to 30 per cent. of the total births.

As regards the coat colour of the "bull-dog" calf, it is more often black than red, for the same reason that black is the more common colour of the Dexter. Of the twenty-seven cases examined, twenty were black and seven red, as close an approximation to a 3 : 1 ratio as can be.

Of the twenty-seven cases examined, twenty-one were males and six females. For a long time none but males were received, which led to suspecting sex-linkage. Later, however, six female "bull-dogs" were obtained; at first these were regarded as possible cases of abnormal differentiation of the sex-organisation in a male. But the demonstration of definite ovarian tissue in the gonads had made it certain that they were female, and the condition, therefore, is not sex-linked. In the older fœtuses the scrotum is well defined, as is also the vulval cleft, but in the earlier specimens the sodden skin and the great rent in the abdominal wall make the identification of the sexual apparatus peculiarly difficult. Moreover, since the specimens cannot be examined until at least eighteen to twenty-four hours after delivery, the histological evidence is rather weakened. But the evidence is such that it shows quite definitely that the "bull-dog" may be either male or female, though, if the series of cases examined can be regarded as a representative sample, the majority of monstrous calves are male.

The Pathology of the Monstrous Calf.

Fœtal anasarca in the great majority of cases is present. This condition is not uncommon in cattle and is almost invariably associated with the death and abortion of the fœtus at the sixth to seventh month. According to Williams [27], fœtal anasarca

has been recorded only in ruminants among the domesticated mammals. The cause is not known; it has been ascribed by some writers to a congenital absence of the thoracic duct. In the case of the "bull-dog" it is invariably associated with hydrops amnii, and it is reasonable therefore in this case to suspect that both conditions are due to one and the same cause, although in ruminants generally there is no doubt that the two conditions can occur quite independently.

Hydramnios.—The normal amount of fluid present in the amnion of the cow is about five to six litres, the amount in the allantois about six to fifteen litres. Any material excess is considered abnormal. The amniotic fluid is clear and the allantoic turbid in later pregnancy; the fluid evacuated in the case of the "bull-dog" calf is clear; the condition present in the case of the monstrous calf is probably hydramnios and not hydrallantois. When examined, no definite cell elements can be recognised in either stained or unstained preparations. The amount of fluid evacuated in one case was approximately 160 litres. Hydramnios is not uncommon in cattle, and is the rule in such species crosses as *Bos americanus* × *Bos taurus*, or *Bos americanus* × *Bos indicus*. Williams [27] records that in one case (not in the Dexter) after trocarization of the fœtal membranes and the withdrawal of twelve to fifteen gallons of the fluid, the original volume was restored within forty-eight hours. The cow showed signs of great thirst, and the author remarks that "apparently the water consumed went almost immediately to the fœtus and was deposited into the fœtal membranes, while the cow, drinking greedily, was suffering from water-starvation."

The exact cause of hydramnios is not known, nor can it be until the origin of the liquor amnii itself has been demonstrated. The prognosis in cases of severe hydramnios in cattle generally is very unfavourable both for the cow and calf, for, as a result of the pronounced uterine dilatation and uterine paresis, the cervix is not dilated naturally, and the abdominal muscles, losing tone for the same reason, do not aid in the expulsion of the fœtus. Delivery is always by operative procedure, as is also the removal of the placenta. In the Dexter, however, the prognosis is entirely satisfactory as far as the cow is concerned; normal labour pains come on, the cervix is dilated, and the fœtus is expelled without any artificial interference, unless it is an older fœtus, for then the head cannot pass the pelvic brim, and operative interference is imperative. The placenta must be removed manually in most cases. The difference in the prognosis in the case of the Dexter and other breeds rests on a difference in the general musculature. The Dexter is a peculiarly muscular individual, and can withstand much better the stretching which hydramnios involves.

Hydrocephalus was in one case associated with hydramnios and fœtal anasarca. It was greatly pronounced, there being literally no brain.

The Skeleton.—The shape of the skull of the monstrous calf is characteristic. Brachycephaly is marked, the cephalic index being about 100 per cent. and the skull being diminished in length and enlarged in width. The head is large, with bulging forehead and parietal eminences; the nasal region is much depressed. The bones of the vault are thicker than is usual, and the most striking feature of all is the extreme shortness of the base. The supra-, ex-, and basi-occipital, the basi-, ali-, and pre-sphenoids are fused into one mass of bone, and no suture of any sort can be identified. The orbito-sphenoid is distinctly delimited. In a normal Dexter fœtus of seven months the basi-occipital measured 3·1 cm. and the basi-sphenoid 2·5 cm., giving a total antero-posterior length of 5·6 cm., when measured on the exterior of the skull, and one of 5 cm. when measured on the interior aspect. These combined bones in a "bull-dog" fœtus of the same age measured 1·2 cm. and 1·3 cm. respectively. In the normal, the foramen measured 2·6 × 2·8 cm., in the bull-dog it was 1·8 cm. long and was waisted, measuring 0·9, 0·8, 0·9 cm. in width. No distinct condylar faces were discernible. Internally the ethmoid in the normal covered the orbito-sphenoid; in the bull-dog it did not.

The vomer in the monstrous calf is extremely robust and has a very broad articulation laterally with the palatines. There is no hard palate and the nasal portion of the skull is completely exposed ventrally in consequence of the entire absence of any inward growth of the maxillæ and palatines. The posterior palatine processes of the premaxillæ are present, being fused with the anterior end of the vomer. The maxillæ are greatly foreshortened, as are also the nasals. The foreshortening of the maxillæ is illustrated by the unusual prominence of the lachrymals and by the fact that while the general contour and proportions of the post-palatine processes of the maxillæ are normal, the premaxillæ, normal in design, practically come back to the level of the maxillo-palatine suture. Viewed ventrally, the premaxillæ lie much deeper than the inner margin of the maxillæ and palatine, the contour of the latter bones being such that there is no suggestion of any effort to make a plate. In this report the skull is distinctly reptilian. The abnormalities of the skull are such as affect its posterior fossa, and except for various degrees of asymmetry, and for the greater thickness of the vault, the remaining peculiarities are such as might follow from the abnormality in the ossification of the base. The skull of the "bull-dog" fœtus resembles that of the bull-dog in one respect only: both show foreshortening of the facial region due to an arrest of development of the nasals and maxillæ.

In the case of the limbs, the epiphyses of the long bones do not differ materially from those of the normal, but there is a profound difference in the length of the shaft. The shortening affects the proximal bones of the limb more than the distal. The digits are separated more widely than in the normal calf of the same age. Sections of the epiphyseal line of the long bones of the limbs show certain characteristic features. Normally, bone formation proceeds by (1) endochondral ossification at the

junction of epiphysis and diaphysis, determining growth in length; and (2) periosteal ossification determining growth in thickness. In endochondral ossification three zones can be distinguished in the area between the undifferentiated cartilage of the epiphysis to the diaphysis: (1) the zone of proliferating cartilage cells in which the multiplying cartilage cells lie in a clear matrix: (2) the zone of parallel columns of cartilage cells in which the hyaline matrix is the seat of calcification, and (3) the line of ossification in which each column of zone (2) extends as far as the bone marrow, from which vascular loops extend to erode the cartilage columns in a regular manner. The septa separating the columns become eroded and denuded of their cells and become encrusted with calcareous salts, and on their surfaces osteoblasts are deposited by the vascular loops. These osteoblasts lay down successive layers of true bone whilst the calcareous material of zone (2) is removed by osteoblasts.

In the case of the monstrous calf, zone (1) is unaltered, but on the surface of this there is a vascular fibrous area enclosing small islets of cartilage. There is no zone (2), the columnar arrangement of the cartilage cells being entirely absent, and the cells, few in number, are scattered irregularly. The matrix is not hyaline, but shows fibrillation and the deposition of calcareous salts is irregular. Zone (3) is thin and irregular. Endochondral ossification occurs, but the absorption of bone trabeculæ is defective, so that reconstruction of the cancellous tissue fails. The trabeculæ are excessively thick, with comparatively small rounded areolæ between them. The condition is one of abnormal endochondral ossification in that there has been defective absorption at the stage of secondary areolar formation. Periosteal ossification in these cases is normal, and the abnormality is restricted to the epiphyseal line where the cartilage cells are entirely passive, where there is no division, no column formation, and no vacuolation and hypertrophy.

The vertebral column is also involved, in some cases being less than half the length of that of a normal fœtus of the same age, and along with this abnormality there are others affecting the size and shape of the thorax and of the pelvis. The conditions found in the case of the " bull-dog " calf are such as are found in the clinical and pathological entity known as achondroplasia in the human. It would seem that the exhibition type Dexter is itself a low-grade achondroplast and that the " bull-dog " calf produced by the mating of two such individuals is a high-grade achondroplast, exhibiting the classical features of the condition in a most pronounced form. If the exhibition Dexters are simplex for the factor corresponding to the achondroplasia-like condition (Ss), then 25 per cent. of their calves should be high-grade achondroplast (SS).

The Etiology of Achondroplasia.

In the case of the human, many and varied causes have been suggested. Bohn and Schwab as early as 1868 suspected a disturbance or an insufficiency of the placenta. Parrot (1876) considered that a congenital nutritive disturbance of the cartilage cells was responsible. Klebs (1889) suggested that a compression of the fœtus by the umbilical vesicles was the cause. Von Franqué (1893) and Rindfleisch (1889) also suspected mechanical pressure. Dor (1893) suggested that an auto-intoxication was the cause. Poncet and Leriche considered that the achondroplasts constituted a distinct race, while Buck and Mayer (1900) held that the condition was a hereditary process and that the most severe cases were the last of a degenerate race. Porak and Durante (1905) inclined to the opinion that the condition was sclerosis of cartilage resulting from an auto-intoxication. Cestan and Regnault described the condition as a form of intra-uterine rickets. Marie (1900) suspected abnormality of some gland of internal secretion, while Lugano and Devay agreed with Leblanc regarding a mal-functioning of the thyroid as the cause. Collman described a case in which the thyroid was much enlarged, as did also Virchow and Neumann. Bowlby, on the other hand, records a case in which the thyroid was absent. Regnault, however, concludes that in the majority of cases this gland is normal. Vargas held that the thymus was responsible, while Parhon, Shunda, and Zalplachta (1905) went further by suggesting that the condition was due to a combination of hypofunctioning of the pituitary, thyroid, and thymus, together with a hyperfunctioning of the sexual glands. Murk Jansen [14] advanced an ingenious hypothesis to explain the conditions found in these cases. He argues that the responsible cause is a compression of the fœtus by a too small amnion or by a hydramnios. Keith (15) disagrees emphatically with Jansen's conclusions, pointing out that a comparison of such contrasted conditions as the frontocephaly of achondroplasia and opisthocephaly and simoprosopia leads directly to the conclusion that such differences in end-results can be explained in terms of different action on the part of the agencies regulating growth. This growth-regulating mechanism is in all probability the endocrine system, and Keith argues that in the light of recent advances in endocrinology it is indeed probable that the stimulus which brings about the preparatory pre-ossification changes in bone formation is an internal secretion " such as we may expect to arise either in the pituitary, thyroid, suprarenal or genital glands, or by an interaction of secretions from all of these," and that the cause of achondroplasia is a malfunctioning of one or more of these glands of internal secretion.

The present study has not furnished a complete answer as to which, if any, of the glands of internal secretion is to be regarded as the responsible causal agent in the production of achondroplasia, assuming, that is, that this condition in the bull-dog calf is achondroplasia. But this much is certain: there is profound abnormality in some of the ductless glands. If it is desired to investigate the cause of achondroplasia in the human, the most satisfactory way will be

to maintain a herd of Dexters and to produce abortion of fœtuses during the first three months of pregnancy.

The Pituitary.

In the case of the human achondroplast smallness of the pituitary has been commonly reported, and this fact has been considered to be of some significance, as it has been conclusively established that this gland is concerned in the normal growth processes. But no definite and constant histological abnormality of the pituitary has been found. In the case of the "bull-dog" fœtus, the pituitary is definitely smaller and is more compressed than in the normal. Histologically it presents the usual structure, except that in many cases there are areas of oxyphil cells in the pars intermedia. The cells of the anterior lobe appear to be more closely packed than is usual, and the vascularity of the gland to be less than in the normal. It is not profitable to discuss the possible significance of such vague impressions as these. But advantage was taken of the melanophore test devised by Hogben and Winton in order to examine the functioning of the posterior lobe of the pituitary in the monstrous calf. These workers have shown that following an injection of a minute quantity of posterior lobe extract into a frog previously kept under those conditions which conduce to skin-pallor, there is a very characteristic and rapid darkening due to a marked expansion of the melanophores. In the case of the normal cattle, pituitary is active, as estimated by this test, at the beginning of the third month of fœtal life. The pituitary is ground up in a mortar with sand, with distilled water, and the extract injected intra-abdominally. In the case of the "bull-dog" fœtus, the pituitary of a six months' specimen gives a very doubtful reaction. A four months' pituitary gives a still more doubtful reaction. It is granted that this test is one for posterior lobe activity, and that a malfunctioning of the pituitary which would constitute a possible cause of achondroplasia would be one involving the anterior lobe. Nevertheless, it would appear to be not without significance that in the "bull-dog" fœtus the posterior lobe is, physiologically, relatively inactive at the fourth and sixth months; it is not unreasonable to think that the measure of the activity of the posterior lobe can be regarded as an indication of the functioning of the gland as a whole.

If this is so, then indeed there is reason to suspect that a mal-functioning if the pituitary during the earlier months of fœtal life is responsible for the abnormalities in ossification and in growth. If, for example, the pituitary does not function properly at the time when the normal process of ossification begins, and if the guiding stimulus of the pituitary is necessary for the normal development of bone, then a retardation of pituitary activity, or an insufficiency of its secretion, could lead to abnormality in bone formation, and the degree of imperfection in the end-results will vary with the degree of retardation of the pituitary functioning and with the difference in the time at which the different parts of the skeleton become ossified.

The suspicion that a mal-functioning of the pituitary may be involved in the causation of the conditions found in the monstrous calf is strengthened by the work of Krogh [16], who has shown that there is good reason to believe that posterior pituitary substance is concerned in the production and maintenance of capillary contractile tonus. Insufficiency results in capillary dilatation and œdema. In this way pituitary mal-functioning can lead to anasarca, hydrocephalus and hydramnios. Moreover, it was found by Smith—and this finding has been confirmed by Hogben—that general œdema commonly followed injection of pituitary extract into larval amphibia.

In the case of the "bull-dog" fœtus, Seligmann (1904) [22] found that the thyroid was abnormal and concluded that the condition was one of fœtal cretinism. In seven cases the thyroid was œdematous and purple: the isthmus was absent or irregular in shape. Histologically the gland consisted of masses of more or less cubical or spheroidal cells and the capillary network was extremely dense. Very few vesicles and sometimes only the faintest trace of a vesicular arrangement could be detected. There was complete or almost complete absence of colloid, and the lumina of the vesicles were packed with cells. In 1911 Sheather [23] described the thyroid as being normal in size, shape and histological structure, except that there was a slight excess of interstitial tissue in some parts of the gland. The vesicles were perfectly formed and filled with colloid. Crew and Glass (1922) [5] described the thyroids of five fœtuses and demonstrated that in these cases the thyroid did not show the histological features of a hypofunctioning, but rather that of a hyperfunctioning gland. In the large series of cases which have been examined the thyroid has varied considerably. In some, mostly the younger specimens, it has not been remarkable; in others it was enlarged and the histological picture was that of a thyroid from a case of hyperthyroidism, no colloid being present, the small irregular vesicles containing papillary in-growths of epithelium and desquamated material, and the section consisted of masses of solid cellular hyperplasia. In the older specimens the thyroid showed the typical signs of involution, the vesicles were enlarged, irregular and full of colloid, the epithelium low and the previously hyperplasic intervening tissue undergoing retrogression and transformation into fibrous tissue.

The sequence of events as suggested by the different histological appearances seen in different cases would seem to be: first, a developing thyroid, then a hyperplasic hyperfunctioning thyroid, and finally an involuting gland with fibrous atrophy and progressive hypofunctioning. Such a scheme would accommodate the different descriptions which have been given by previous writers and would explain the diagnosis of fœtal cretinism. This seriation of events is typical of cretinism, but it is also typical of the course of events following removal of the anterior lobe of the

pituitary in mammals, as has been shown by Cushing [6] and more recently by Dott [7]. The lesions found in the thyroid do not necessarily indicate that the condition is that of fœtal cretinism. The mother of a monstrous calf is not herself goitrous. Shattock, in Seligmann's paper [22], suggests that the maternal thyroid is probably sufficient for the mother's needs only, but the experiments of Halstead and of Edmunds on the dog suggest that, were this so, the thyroid of the fœtus would be greatly enlarged. The conditions found in the thyroid of the "bull-dog" fœtus can be regarded as secondary to a mal-functioning of the pituitary.

Since Gudernatsch [10] demonstrated the efficiency of thyroid feeding to accelerate Anuran metamorphosis, the value and specificity of this test, at least as an indicator of the iodine content of the gland, as demonstrated by Lenhart [18] and Swingle [25], has been universally recognised. Using the axolotl—the larval form of the Mexican salamander—there is the opportunity of demonstrating thyroid activity in a most spectacular way, for a single meal of fresh gland suffices to induce metamorphosis. This is a critical test for thyroid iodine; the transformation does not occur in aquaria without this stimulus and it cannot be induced by the oral administration of inorganic iodine. This axolotl test has been shown to be a specific test for thyroid activity by Laufberger [17], Jensen, L. Kaufmann, and by Huxley and Hogben [13]. An axolotl weighing 64 grm. was fed with 2 grm. of fresh thyroid substances taken from a seven months' "bull-dog" fœtus. Complete metamorphosis resulted in shedding of the larval skin in the usual twelve to fourteen days after the thyroid meal. A second axolotl of 23 grm. was fed with 1 grm. of thyroid from a four to five months' "bull-dog" fœtus. Metamorphosis occurred with shedding of the larval skin at about the same time as in the previous instance. This test cannot be applied successfully before the fourth month of intra-uterine life in the case of the normal cattle fœtus. From the fourth month onwards the thyroid is active, as estimated by this test, but before it is not. It will be noted that, according to the tests used, the pituitary is functional before the thyroid. These observations, give a clear demonstration of the fact that there is present physiologically active iodine in the thyroid of the monstrous calf of the Dexter at an early stage of fœtal life. They do not support the contention that the condition is that of cretinism.

The *adrenals* have in no case been perfectly normal. In some there was an undue amount of fibrous tissue in the cortex and in the medulla. In the majority there were areas of cartilage and, in many, areas of cartilage bone with Haversian canals and areas of calcified cartilage with osteoblastic bone on its surface. The different stages in this bone formation would appear to be: hyperplasia of fibrous tissue, formation of hyaline cartilage in these areas, fibrillation of the cartilage, calcification of the matrix, absorption of the calcified cartilage by osteoclasts, and deposition of osteoblastic bone on the surface. The exact significance of this cartilage bone formation in abnormal situations has not been established, but since similar areas have been found in other organs in which there is plentiful connective tissue, it is suggested that the condition is a general one and possibly is secondary to a mal-functioning of the pituitary.

No other abnormality of the endocrine system was encountered. It may be remarked, however, that, in contra-distinction to the general finding of sexual precocity in the living human achondroplast, the differentiation of the sex-organisation in the case of the monstrous calf of the Dexter is not so advanced as in a normal cattle fœtus of the same age.

The tentative conclusions arrived at from this study are the following: Very possibly the condition results from a mal-functioning of the pituitary between the second and third month of intra-uterine life. Under these conditions the proper control of cartilage bone-formation is lacking. The thyroid undergoes hyperplasia, and this is followed by involution. The severity of the condition may be determined by the degree of retardation in the functioning of the pituitary or by the delay in the production of an efficient internal secretion of this gland. It is not claimed that a definite answer has been given to the question as to the primary cause of the condition. It is felt, however, that the study of the monstrous calf of the Dexter has provided a strong argument in favour of using this material for a complete and thorough study of the conditions akin to achondroplasia. A small herd of Dexters would provide the finest experimental material for a demonstration of the bearing of genetics upon pathology and upon the science of animal breeding.

Summary.

(1) A review of modern conceptions concerning the condition of achrondroplasia in the human is given.

(2) A description of the "bull-dog" calf is given, and it is shown that the conditions met with in such are identical with those of achondroplasia.

(3) It is suggested that the incidence of these abnormal calves can be interpreted in genetical terms, and the inference is drawn that the achondroplasic condition is a simple Mendelian dominant character; that the exhibition type Dexter is heterozygous for this character, and therefore the mating of such individuals must yield about 75 per cent. of bull-dog calves.

(4) Reasons are given for suspecting a non-punctual functioning of the pituitary during fœtal life as the primary cause—based on the genotype—of this condition.

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Mr. L. P. PUGH said that Dr. Crew's paper opened up a wide field of thought and research. He agreed with his suggestion that the "bull-dog" calf was in all probability a non-viable form of achondroplasia. He wondered if Dr. Crew could give other examples of mutations that were additive in action. He thought the study of aborts intentionally produced in Dexter cattle likely to give very useful knowledge, and explained how such abortion could be produced. He expressed doubt as to whether the whole question of achondroplasia could be settled within the confines of a study of the Dexter breed, and said that he would like to see a general survey of all achondroplasic-like animals (of which there were many) in order to try to detect some common operative factor. That the head could be achondroplasic and not the limbs, as in the case of the pug-dog, and the reverse as in the case of the dachshund was a fact that needed explanation. Mr. Pugh expressed the hope that Dr. Crew would be given the facilities for extended study of the Dexter breed and the aborts from them, and said that he felt sure that it would result in a great deal of useful knowledge both in genetics and in the study of the endocrine glands.

Foot-and-Mouth Disease in Essex.

The existence of foot-and-mouth disease was confirmed last week on a farm near Loughton, Essex. The total stock on the premises consists of thirty-six cattle, of which, ten cattle were found to be affected with the disease. All the animals were slaughtered. There has been no outbreak of foot-and-mouth disease in Essex since February last. There was, at the moment of writing, no information available as to the origin of this new outbreak, which appears to have existed for some days. It has consequently been necessary for the Ministry to make an Order prohibiting the movement of animals in an area of about fifteen miles radius round the infected farm.

The Veterinary Record.

20th September, 1924.

ABERDEEN: A CONGRESS RETROSPECT.

It would indeed be futile at such an early date to make a properly-balanced survey of the Aberdeen Congress. Events are so recent, minds and bodies have been so active, that a short period of rest and retrospective contemplation is needed before we can grasp the fuil significance of the wonderful assembly of last week. A few features, however, stand out prominently, and will probably remain as lasting impressions of what must have been the most remarkable Congress of our profession that has ever been held. First, the numbers. When Aberdeen was selected as the venue of the meeting many wise heads were gravely shaken over the folly of inviting disaster by going so far North. That few, if any, South of the Tweed would undertake the journey and the expense; that a "granite city" did not sound hospitable, were only two of many adverse opinions expressed which received emphatic contradiction last week. About twice as many, or more, were present as were present at York last year, while the hospitality of Aberdeen will remain in our memories as something of a nature all its own; unlike anything we have before experienced and of a generosity which left us wondering. The papers and discussions will be published, and our readers will judge of them for themselves, but they will miss the eloquence of some of the speakers. No one who heard Dr. Crew reply will ever forget his masterly address, which held his audience spellbound for over an hour. Many expressed the opinion that they would gladly go from South to North for that hour alone and feel themselves amply rewarded for their trouble. Professor Neilsen's paper and demonstration mark a definite step forward in the direction of putting veterinary science and manipulative skill to commercial advantage in a new field, the possibilities of which we can at present only conjecture. The social functions will probably remain the outstanding features with most, since they were of a character to distinguish them from any previous meeting. The civic luncheon was not only dignified and arranged with scrupulous care, but was sumptuous and genial—a pattern of what a public luncheon should be. The annual dinner was a record for the Association in more ways than one. That two hun-

dred and twenty-five veterinary surgeons and their friends should have dined together in the far north was truly remarkable, and all previous records were exceeded by more than a hundred per cent. A more perfectly-organised and more successful dinner could not be wished for. The President's reception, so excellently arranged that everyone had ample opportunity for friendly conversation and bodily refreshment, the kindly words of welcome and the thoughtfulness of both Mr. and Mrs. Dawes for each and all of their two hundred and fifty guests will long be remembered. The trip to Braemar on Friday was to many the most enjoyable feature of the week, and it must be left to others to write the praises of the wonderful scenery through which the party was conducted; suffice it to say that mountains, valleys, moors, burns and rivers, and last, but not least, the purple heather made an appeal to all, and one and all were sorry when the day was over.

Not one of us who was there will ever forget the hospitality of Aberdeen. We have referred to the civic lunch as a social function; we refer now to the words of welcome, the tone and manner of the speeches of our hosts. Sir George Adam Smith, both in his academic welcome and at other times, added a dignity and a cordiality to our Congress which was somewhat novel to those who do not know what a Scotsman can be in his own home. The splendid send-off received from the Very Reverend Principal was confirmed later by the Lord Provost, whose speeches, both at lunch and dinner, gave inspiration to all to live a life which would be of service to the country and the Empire. Not least enjoyable was the very pleasant evening spent at the Theatre Royal as guests of the Warden Insurance Company, who spared neither trouble nor expense on our account. This episode marked once more the old-standing, friendly relations between this Company and so many of the members of our profession.

Above all the features we have mentioned, however, there was an indefinable something—an atmosphere—a something which could be felt rather than seen, a feeling of satisfaction and good fellowship. It was evident from the first day to the last, and it was evidenced in the free intermingling of all parties and the friendly nature of the debates. We think this can be directly attributed to the personality of Mr. and Mrs. Dawes. Our President's kindly good nature dominated all the proceedings, and we think that all who were privileged to be at Aberdeen will unite in saying that to a very great extent the amazing success of our Congress was due to his personal success as President for 1924.

CLINICAL NOTES.

The association of colour and constitutional peculiarity in the Cat.

A letter appeared in the *Lancet* for July 19th, 1924, over the signature of Dr. Edmund Hobhouse, quoting from the April issue of the *Quarterly Journal of Medicine*, an article by Dr. Stobie on the association of blue sclerotics with brittle bones and progressive deafness. Dr. Hobhouse goes on to say that he read the statement, in one of Darwin's works, that white cats with blue sclerotics are always deaf.

Darwin in his *Origin of Species* says, among other instances of correlation, that white cats with blue eyes are invariably deaf and that colour and constitutional peculiarities go together.

It would indeed be interesting if any of your readers had met with authentic cases showing that the above rule, as laid down by Darwin, had its exceptions. Dr. Stobie associates blue sclerotics with brittle bones. The writer is not aware of any recorded instance of this in the lower animals. It is possibly a matter which would escape even the most vigilant, but it would be interesting to know if this phenomenon, which appears to be present to some extent in the human subject, is also present in the lower animals.

Here, again, is an instance in which the observant practitioner can assist his professional brethren. Such points as the one we quote are rarely studied as closely as they might be, but are too frequently brushed aside as being of no importance.

Questions of this nature are constantly being raised in medical and other journals, and it is the veterinary practitioner who should be able to reply and settle all doubts, for his opportunities are great and his opinion cannot be too highly estimated.

G. W. D.

A Note on Psittacosis.

With Reports of Two Related Cases.

By G. Lovell Gulland, C.M.G., M.D.

(Reprinted from *The British Medical Journal*).

It has long been known that parrots, both from America and Africa, especially when imported in large numbers, often die in high percentages, doth during the voyage and after arrival. It is also well established that the disease from which they suffer can be transmitted to human beings, and that this occurs with fair frequency and probably oftener than is recognized. Apparently the first recorded epidemic was in 1879 (Ritter[1]), and every few years since then human epidemics have been reported in Germany, France, Italy, America, and this country. The specific bacillus (*B. psittacosis*) was isolated by Nocard in 1893 from the bone marrow of affected parrots, and in 1896 by Gilbert and Fournier, from human beings as well as parrots, in another small epidemic. It belongs to the same group as *B. enteritidis* Gaertner,

B. paratyphosus B, and *B. aertrycke*. Its relations have recently been studied by H. M. Perry.[2]

In parrots the symptoms are loss of appetite, debility, drowsiness, drooping of the wings, and severe diarrhœa, sometimes associated with hæmorrhage. Death may be preceded by convulsions. The mortality seems to be over 50 per cent. The disease appears to occur mainly, if not entirely, in newly imported birds, or those which have come in contact with them on their arrival. In fatal cases the bacillus is widely distributed throughout the body of the bird, and the dejecta are found to contain large numbers. It is apparently from this source that the disease is conveyed to human beings, and there can be no doubt that it was so contracted in the two following cases:

Case I.

In the autumn of 1923 I was asked to see a lady with pneumonia in a town in Scotland. I had seen her previously at intervals since 1914. She had been originally a strong woman, but since nursing her father during a long illness, some years before, had been in poor health, and suffered from indigestion, anæmia, eczema, etc. These ailments were got rid of with some difficulty by the end of 1915, and except for a relapse in 1918 she had been increasingly stronger.

The present illness had begun five days before, with acute pain in the right side of the chest and a rise of temperature to 103°, but apparently no definite rigor. During these five days the temperature had ranged between 101° and 103·6°, pulse 108 to 120, respirations 28 to 36. When I saw her she was quite clear mentally, there was no cyanosis, the tongue was fairly clean and moist, the heart not dilated and sounds good, pulse 112, blood pressure (M.S.) 120. There was dullness with bronchial breathing at the root of the right lung and above it, with some crepitations and friction; lungs otherwise clear, very little cough, and no sputum. She looked unusually well for a patient in the fifth day of pneumonia, and there seemed no reason to anticipate anything else. The temperature fell by crisis two days after my visit, but began to rise again in a few hours in step-ladder fashion. When I saw her again, on the eleventh day of her illness, it had reached 102°. She was obviously much more seriously ill, though still clear mentally; the tongue was very dirty, the pulse 124, and the heart feebler. The right lung had entirely cleared, but there was a fresh patch with typical signs at the left base. During the next few days she became steadily worse, the pulse reaching 160 and respirations 60 towards the end, temperature running between 100° and 102°, and she died on the fifteenth day of her illness. Throughout there were no abdominal symptoms, no distension, and no enlargement of the spleen.

Case II.

A sister, younger by some years, and much more robust, was taken ill on the sixth day of her sister's illness, with a rigor, temperature 103°, pulse 120, respirations 32. When I saw her first, at the time of my second visit to her sister, she had a pneumonia patch in the front of the right lung, and another at the left base. The former had cleared up almost entirely six days later, the latter remained unaltered, but a fresh patch had appeared about the root of the left lung. She was never so seriously ill as the first patient, but the temperature ran much the same course, between 102° and 103° for the first week. There was no critical fall, but a fall by a slow and irregular lysis during the second week, with an evening rise to 99° for three days more. The lungs cleared slowly, and after the temperature had been normal for a week there was a pleural effusion on the left side with slight fever; 10 oz. of clear fluid were drawn off. This on culture proved to be sterile. Convalescence was slow and tedious.

In this case, again, there were no abdominal symptoms, very little cough, and no sputum. A feature of both cases was a depressed mental state, though neither was delirious at any time.

The second sister had been much with the first, and to begin with we thought one had infected the other, but attention was soon drawn to possible connexion of both cases with a parrot. The bird, a young African parrot, had been received from London almost exactly a month before the first case began. It suffered from diarrhœa all the time: the two sisters looked after it and cleaned its cage; no other member of the household came in close contact with it. It died the day before the first case began. On inquiry, it was found that, at the shop from which the bird came, numerous parrots—blue-fronted Amazons from South America—had died during July and August, and that officials of the Board of Agriculture had isolated pneumococci *post-mortem*.

The symptoms of psittacosis in human beings are almost invariably such as I have described in these two cases. It is a striking fact that a disease which is obviously of abdominal type in the bird is seldom associated with abdominal symptoms in the human being, but takes the form of an atypical pneumonia, with or without additional bronchitis. The onset is generally acute, often with a rigor, and the fever is usually continuous, highest during the first week or so, with a tendency to fall by lysis, and lasting, in cases which recover, from two to three weeks, sometimes a little longer. The charts published by Vickery and Richardson[3] are very like those of my cases. Mental depression is a marked feature, headache is common early. The spleen may or may not be enlarged, rose spots and even petechiae may appear, but do not seem to be common. My cases reminded me of paratyphoids with pulmonary complications, but in both the pulse was rapid throughout, corresponding more closely to the height of the fever than it usually does in enterics. There was no distension of the abdomen.

The mortality is generally stated as about 40 per cent., and the disease is naturally more dangerous in elderly or debilitated persons. There seems to be difficulty in obtaining the bacillus from the human being during life; it has been found in the heart blood after death. Agglutination in man is feeble, apparently not beyond 1 in 60, and soon disappears.

I have recorded these cases because of the fatal character of the disease and the difficulty in diagnosis. It is more than likely that the disease is more frequent than is supposed; it might easily be diagnosed as pneumonia, or influenza with pneumonia, in the typical cases, or as paratyphoid in the rarer cases without marked pulmonary involvement. Its occurrence in house epidemics and its relation with parrots are the obvious criteria.

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2 Perry: *Brit. Journ. Exper. Path.*, 1920, p. 1.

3 Vickery and Richardson: *Trans. Assoc. Amer. Phys.*, 1904, vol. 19, p. 364.

ABSTRACT.

Hypoderma Experimentation.

As has been the experience of other investigators, Roubaud and Pérard have obtained very poor results in their attempts to hatch flies from the larvæ emerging from the skin. From over a hundred larvæ, a good number of which formed pupæ, only three or four flies have been obtained. From the context it appears that the larvæ used had not made their exit from the skin spontaneously, but had been pressed out. The experience of other investigators appears to indicate that this in itself is a factor adverse to the obtaining of the imago. This failure to obtain flies has prevented the authors from carrying out some of the experiments that had been designed, and they therefore concentrated their attention upon the question of the apparent immunity possessed by young animals and those of mature age as compared with animals from two to four years of age. Statistics collected in the abattoirs of Paris show that 78 per cent. of infested animals are between two and four years old, 11 per cent. are from one to two, and 11 from four years upwards. On the other hand, Carpenter and Steen in Ireland found that the majority of infested animals were about a year old, calves coming next in order of frequency. It has also been observed that animals under four years of age are usually far more heavily infested than aged animals. The differences observed in the infestation of animals at different ages are referable to the difference in age at which they are sent to pasture and the long period of development of the parasite. There appears to be evidence that the comparative freedom of adult animals from infestation is in some way connected with an acquired immunity, and a similar series of facts has been shown in the case of another parasite, *Cordylobia anthropophaga*. In the case of Hypoderma the authors think that this immunity may result from the absorption of the tissues or secretions of larvæ which fail to achieve their full development. The possibility of immunizing cattle experimentally against Hypoderma has suggested itself to the authors and they have carried out experiments with extracts of third stage larvæ. In view of the difficulty of obtaining these larvæ, they have carried out a parallel set of experiments with *Gastrophilus intestinalis*. This parasite is readily obtainable. Extracts prepared with water and with glycerine have been used.

The extracts of Hypoderma have been found to be relatively non-toxic for rabbits, guinea-pigs, rats, and mice.

Only one experiment appears to have been carried out with a bovine animal. This was given a series of subcutaneous injections of extract of third stage larvæ after filtration. They have not observed any immediate reaction nor any evidence of anaphylactic shock. It is noted that the animal used had not previously been infested naturally. Reference is made to the results obtained by Hadwen, Bruce and Brodersen.

In their experiments with extracts of gastrophilus the authors have found, as has de Kock, that unfiltered extracts are markedly toxic for laboratory animals, while filtered extracts produce no such effects. In all the experiments carried out freshly prepared extracts appeared to be more active than extracts which had been desiccated. An attempt has been made to immunize two bovines, one with Hypoderma extract and the other with Gastrophilus extract. These animals have been exposed to natural infection, but the authors have no information as to the results.

Experiments designed to show whether small animals acquired any immunity as a result of injection of extracts failed owing to bacterial infections. These animals had larvæ of the first or second stage introduced under the skin.

[Roubaud (E.) and Pérard (C.). ETUDES SUR L'HYPODERME OU VARRON DES BŒUFS ; LES EXTRAITS D'OESTRES ET L'IMMUNISATION. (*Hypoderma bovis*. Extracts of the larvæ, and immunization.)—*Bull. Soc. Path. Exot.*, 1924, Mar. 12th, Vol. 17, No. 3, pp. 259-272.—*Ex. Trop. Vet. Bull.*, August 31st, 1924.]

Infectious Bovine Abortion.

DISCUSSION AT THE FIFTH PAN-AFRICAN VETERINARY CONFERENCE.

The following discussion on infectious bovine abortion took place at the Pan-African Veterinary Conference held, with Mr. R. Eustace Montgomery in the chair, at Government House, Nairobi, in April, 1923.

Mr. W. KEARNEY (Assistant Chief Veterinary Research Officer, Kenya Colony): Infectious bovine abortion is undoubtedly a complaint of far less economic importance at the present time in Eastern Africa than the diseases you have been dealing with up to now. Nevertheless, it should, in my opinion, receive your most earnest attention at this Conference, in view of its possible seriousness arising before another Pan-African meeting of veterinarians takes place.

We know that in countries like Southern Rhodesia and South Africa, where the more serious epizootics, such as rinderpest, are absent, infectious abortion plays no small part in veterinary activities, and it is not unreasonable to anticipate that a similar state of affairs may arise in our local territories before long.

From available statistics the complaint was first definitely diagnosed in this Colony in 1913. Whether it existed before that time I am unable to say, but it would not be altogether wrong to assume that it did. How and from where the complaint was introduced I am also unable to say.

Since 1913 we have found cases present on a large number of European farms, and we can assume with comparative certainty that our native reserves are also implicated. The disease can, therefore, be said to be widespread in Kenya at the present moment.

That the complaint in Kenya is the specific abortion caused by the *bacillus of Bang* has been proved beyond doubt by the application of comparative tests with the causal organism of this country and strains sent us from South Africa and England through Sir Stewart Stockman.

So far we have been unable to collect sufficient data to give dependable figures as to the losses which have occurred from the complaint in the Colony, but during the past twelve months we have diagnosed some forty positive cases out of 130 samples of sera submitted for examination. The positive cases were not confined to a few infected farms in the Rift Valley, for example, for they came from farms as widely apart as Kitale on the Uasin Gishu Plateau and Nyeri near Mount Kenya.

The method of diagnosis employed by us at Kabete is the ordinary agglutination test used in other countries. The technique is simple and the results are reliable. We give a positive return when agglutination is complete at 1 in 100 dilution. Where only a partial agglutination occurs at this dilution we give a doubtful return and ask for more serum.

It might be of interest to some of you, who have not had the time or opportunity to keep in touch with recent research work, to give you a few of the more important facts concerning the complaint which has been elucidated in recent times.

(i.) The commonest mode of infection is per os.

(ii.) The bull is of less importance as a factor in its transmission than was previously thought, though he cannot be eliminated altogether.

(iii.) The causal bacillus remains dormant for indefinite periods in the udders of cows which have had an attack of the disease and recovered, and they are potential sources of infection for that reason.

(iv.) The *bacillus of Bang* and the *bacillus melitensis* of Malta fever have some characteristics in common.

(v.) Immunity can be conferred in non-pregnant animals by the artificial inoculation of living cultures of the bacillus.

We have much to encourage us in our efforts to control and eradicate infectious abortion.

First of all, we must consider the precautions applicable to maintain clean herds free of the disease. The most likely agent to carry the infection to a clean herd is an infected pregnant cow, or a cow which has aborted and whose udder harbours the bacillus. We can protect the healthy herd against animals of this kind by the use of the agglutination test. No bovine should be allowed into the clean herd until it has been subjected to the test. A few weeks' quarantine is essential before applying the test, as antibodies are not usually present until that time, after abortion occurs.

What action should be taken with infected herds is a more difficult problem. Choice may be made of two methods which to my mind would give best results.

(1) Cleaning the herd by using the agglutination test to determine the affected animals.

(2) The application of artificial immunisation.

The first method would be impracticable to apply in a large scale in a country such as this.

The artificial immunisation method with living cultures appears to be satisfactory where we are sure we are dealing with non-pregnant animals, but under conditions pertaining here this is almost impossible.

Mr. Bevan, in Rhodesia, however, claims to have an efficacious vaccine which he can apply with safety to pregnant beasts as well as non-pregnant beasts. If the results are as satisfactory as Bevan claims, I think this Conference might be justified in approaching him on the matter.

I do not consider it wise to discuss the possible relationship which is said to exist between this complaint and Malta fever until more work has been carried out.

Mr. H. E. HORNBY: The question of contagious abortion in Central Africa centres round the question—has it existed in native herds from times immemorial, *i.e.*, is the disease indigenous to Central Africa and very mild in consequence ?

I myself am convinced that the disease exists throughout Central Africa. In North-eastern Rhodesia it is unlikely that it was introduced by the few bulls imported from England, yet there contagious abortion, as confirmed by the agglutination test, certainly exists. Among native-owned herds abortions are frequent, while in European-owned herds of native and grade cattle, the incidence of abortion on the whole is small, but occasionally the numbers increase until they assume the proportions of an outbreak. Nevertheless the disease is not a very serious one.

Mr. J. T. C. BRADSHAW: There is no doubt that, as far as this country is concerned, the disease is more prevalent in European-owned herds than anyone at first thought it to be, and quite recently one owner of stock reported that his losses in one season were 15 per cent. of calves due to premature births, and naturally he wishes to be protected against such losses in the future. The point then arises as regards vaccination in herds where the losses go up to, say, 20 per cent. of calves in a year.

Mr. W. M. POWER: This disease is fairly widespread throughout South Africa, but so far as Natal is concerned it occurs much more amongst European-owned than in native herds. In the reserves very little is known to exist, and in this respect I might mention that these areas are under supervision owing to East Coast fever.

The disease has been imported from England, and doubtless from other countries.

Infectious abortion was only diagnosed positively, I think, about 1910, though it was suspected to exist before this.

It is more prevalent amongst the better bred herds than amongst the common cattle, but it is impossible to say definitely to what extent a disease like this exists.

I have seen a good many outbreaks, and although it is a very serious disease, the losses are not usually as heavy as in England. Cases where heavy losses take place are mostly amongst well-bred dairy herds closely housed and kept under somewhat similar conditions as cattle are kept in England, though I am aware that serious losses have occurred amongst veldt cattle.

I was glad to hear that Mr. Kearney appreciates the difficulty of dealing with this disease by the agglutination method, that is, by picking out infected animals and running two herds. We tried that in Natal some years ago, after the disease first broke out, and we found that

it was impracticable. I consider it is almost impossible for farmers to run two herds, infected and non-infected. They would require two sets of farm buildings, and there may be exceptional cases where it may be done, but on the whole I am sure it cannot ; it is not now a scheduled disease in the Union.

At first when it was diagnosed we considered we were justified in imposing restrictions on cattle movements. That seemed all right while we had a limited number of outbreaks to deal with, but as time went on, and the disease was diagnosed in fairly widespread areas all over the country, there was a general outcry against this. A definite quarantine period could not be fixed, and there was no prospect of being able to raise the quarantine within a reasonable time. As cattle owners began to realise that such restrictions were being imposed, we felt that many were not reporting the disease, and that really our precautions in regard to the farms where we knew it existed had little effect on the spread of the disease. If a farmer did not want to report an outbreak, he did not do so, and it is very doubtful if he was ever found out. He could move his cattle about the country and dispose of them from infected herds, whilst the man who reported an outbreak and asked for a test was shut down indefinitely. The whole matter was then reconsidered, and as a result it was decided to withdraw the restrictions.

The demand to have non-pregnant animals inoculated is increasing in Natal.

I am very sorry, Mr. Chairman, that Rhodesia is not represented here, as information on the present position of the disease in that territory would be interesting.

We came in for some adverse criticism for removing the restrictions against this disease, and it was suggested that the question of the eradication of the disease should have been faced. Consequently, I should like information on the results obtained by maintaining restrictions, as is done in Rhodesia.

Mr. H. E. Hornby : Mr. Power seems to suggest that the disease was introduced into South Africa from Europe, and the reason why the native-owned cattle do not suffer so much as European-owned is because they are not yet as widely infected. May I suggest the alternative theory that native cattle are largely immune owing to long contact with the disease ?

Mr. W. M. Power : I have seen the native cattle act exactly the same as European when exposed to infection. I think the comparative freedom of the native cattle from this disease is due to the fact that they have not been exposed to infection to the same extent as the cattle of Europeans.

Major W. Kennedy : I should be glad to know if the percentage of barren cows in the native territories of the Union is high or low.

Mr. W. M. Power : I should say that the percentage is low.

Mr. F. J. McCall : Contagious abortion amongst native cattle in Tanganyika is not regarded as a problem, neither is its presence recognised by the natives. In view, however, of the remarks just made by delegates from surrounding territories, we may, I think, safely assume that it does exist. Abortions do occur, and those which are not recognised as due to accidental causes are usually attributed to rinderpest ; many barren cows are encountered and the history usually elicited by enquiries on the spot is that subsequent to abortion (the result of a severe attack of rinderpest), the animal failed to again become pregnant.

The position, therefore, is that at present, in view of its comparative unimportance, no official cognisance is taken of the disease and no action or inoculation is contemplated.

Dr. P. R. Viljoen : As Mr. Power has remarked, contagious abortion is extremely prevalent in the Union of South Africa, and indeed is of the greatest economic importance.

Before discussing the administrative control of a disease of this kind, we should be quite clear as to how we stand in connection with our knowledge of the causal organism itself. It has been remarked by Mr. Kearney, and quite correctly, that the most serious source of infection and spread of the disease is the aborting cow, *i.e.*, the uterine discharge, the fœtal membranes, etc., which are derived from such an animal.

Now at this stage it might be necessary to review very briefly our knowledge of the organism inside the animal as well as in the outside world. In the pregnant cow we know that the organism multiplies in the pregnant uterus and that the udder is also infected with the organisms. From such an animal, therefore, there are two sources of infection that may be considered, the fœtal membranes and uterine discharges. In such an animal we know that after a certain period the discharges from the uterus stop completely, and one may assume that when that happens the spread of infection from this source also ceases to a very great extent. Such an animal then would discharge the organisms mostly through its milk supply. Now to me it seems that this source of infection cannot be considered of very great importance on the farm, for the simple reason that cows do not usually excrete any milk whilst running in the pasture. To put it more plainly, no milk escapes from the udder whilst the animal is out at pasture.

Now, taking the non-pregnant animal, we know that non-pregnant heifers and oxen may become infected, although only temporarily ; in other words, the organism must multiply somewhere in the body. As yet, we do not know where this multiplication takes place. As I mentioned before, the organism has for its seat of multiplication the pregnant uterus and the udder. In the non-pregnant heifer or cow, and the ox, these conditions for the growth of the organisms are not available. It appears to me, therefore, of considerable importance that further work should be done in order to find out exactly where else in the body the organism may take a hold and multiply. You will remember that in work that has been done with the disease so far the organisms have been isolated practically from nowhere else except in the regions indicated by me.

(To be continued.)

NOTES AND NEWS.

The Editor will be glad to receive items of professional interest in these columns

Our members will read with interest the following telegram from Professor Vallée, who was invited to be present as a guest at the Aberdeen Congress, which was received too late to be announced at the Annual General Meeting:—

"Désolé ne pouvoir être au Congrès vous exprime sincères regrets et vous prie offrir à nos confrères mes sentiments cordialement dévoués—Vallée."

* * * *

Last Saturday was a sad day of parting. After such a week of happy companionship and enjoyable and profitable meetings, it was hard to break up the happy groups at Aberdeen. Surely there never has been such a jolly gathering of veterinary surgeons ever before.

* * * *

The Lady Barber, of Aberdeen, must have had quite a busy week and will feel the loss of some of her temporary customers. We hear that one respected member found it necessary to get shaved about three times daily.

* * * *

Anxious friends will feel relieved to know that Mr. Brooke succeeded in getting away without losing his umbrella, his stick, his hat, or even his luggage. He nearly went to Inverness instead of Edinburgh by getting into the wrong train, but providentially was rescued in time.

* * * *

We have heard many comments on the wonderful "plus fours" which appeared at Aberdeen. While not so picturesque as the kilt, some of them seem to cut into about as much material. Rather a contrast to the tight breeches and gaiters usually associated with the veterinary surgeon. Some of the gaudy sweaters or "pull overs" defy description.

* * * *

We wish we could get hold of the reporter who made notes of the (unofficial) trial at the Aberdeen Police Court in the early hours of the Thursday, following the dinner. We are sure it would make good reading, in spite of the fact that the "culprit" was charged with some horrible offence in one of the parks. This "felon" must have made a very good defence, as he was at the 10 a.m. meeting just as happy and smiling as ever, in spite of his trying experience.

Royal College of Veterinary Surgeons.

FELLOWSHIP EXAMINATION.

At a special examination for the Fellowship Diploma held at 10 Red Lion Square, London, W.C.1, on Wednesday, 10th September, the following candidate was successful:—T. GRAHAME.

Title of thesis:—Gastric mucosa of the sheep.

Examiners:—G. A. Buckmaster, M.A., M.D.; E. Simpson Shave, F.R.C.V.S., M.R.C.S., L.R.C.P.

FRED BULLOCK, Secretary.

New Money for Agricultural Education and Research.

The Government has decided to provide a further sum of £500,000 for agricultural education and research in addition to the funds already available for that general object, amounting to £1,000,000, under the Corn Production Acts (Repeal) Act, 1921, and about £400,000 per annum from other Government funds. It has been arranged that this new money will be paid over to the Development Fund by the Treasury as required, and that it may be looked upon as provided for use during the next five years. No definite allocation as between Scotland on the one side and England and Wales on the other has been made.

The Ministry of Agriculture and Fisheries is framing proposals for the following schemes to be assisted from this new money:—(a) *Foot-and-Mouth Research* work already in progress; (b) *Economic Research*—scheme for testing new systems of farm management and for strengthening the staff of the Institute of Agricultural Economics at Oxford; (c) *Marketing Investigations*—work of Marketing Commissioner and six Marketing Officers already appointed; (d) *Veterinary Education and Research*; (e) *Agricultural Advisory Scheme*—to complete the existing advisory scheme by the appointment of additional scientific officers, and for a scheme to provide milk analysts at each of the agricultural colleges; (f) *Soil Surveys*—to provide for the extension of soil surveys which have hitherto been started only in certain particular areas; (g) *Additional Research Grants*—to meet the cost of further developments at existing Research Institutes (increases of staff, etc.) beyond those hitherto contemplated; (h) *Vegetable Testing*; (i) *National Institute of Agricultural Botany*—to develop further the Institute's operations, particularly in regard to variety trials of field crops.

CORRESPONDENCE.

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

Proposed National Dairy Council.

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—As a result of the voting by members of the Committee appointed by the Scottish Branch, the following gentlemen are found to have been selected to represent the National Veterinary Medical Association on the proposed provisional Council:—

A. GOFTON, Esq., F.R.C.V.S., Edinburgh,

W. W. PEGGIE, Esq., F.R.C.V.S., Biggar.

I regret the delay in forwarding this information, which has been due to my absence on holiday.—Yours faithfully,

J. HOWARD JONES, Secretary (Scottish Branch), N.V.M.A.

The Abattoir, Gorgie, Edinburgh,

9th September, 1924.

Cleansing "Hypodermics."

To the Editor of The Veterinary Record.

Sir,—By his note in last week's *Record*, Mr. Bibbey draws attention to a point, *i.e.*, the cleanliness of dental syringes, which should go further and include all veterinary hypodermic syringes. Personally, I find the use of these to be increasing daily, especially in connection with the administration of drugs and tuberculin testing. It may not, therefore, be out of place to mention here a simple method of cleansing hypodermic syringes and needles for general daily use, both in the surgery and on the daily round of visits.

Obtain a conveniently-sized bottle, place on a rubber cap, and fill with alcohol. Then, after using the needle and syringe, plunge the former into the rubber cap, invert bottle, and withdraw a small quantity of alcohol into the syringe in a similar way to that used when filling from a rubber-capped bottle of serum or bacterin. Withdraw needle and hold syringe vertically, fully extend the plunger, move backwards and forwards once or twice to clean, then press the whole contents out through the needle. This may be repeated, or the syringe may be first cleaned out with water and emptied before using the alcohol. As a further precaution against rusting of the needle, I use a bicycle oiler filled with 1 per cent. of carbolized ol. paraff. liq., B.P., a few drops of which are forced through the needle by inserting the spout of the can in needle holder and pressing oiler.

Hypodermic needles can now be obtained manufactured from stainless steel; they are far easier to keep clean than ordinary ones.—Yours truly, W. S. Stevens.

Southill, Wincanton, Somerset,
6*th September*, 1924.

Dr. C. H. Usher.

To the Editor of The Veterinary Record.

Sir,—I think it well to call attention to the error in the description of Dr. Usher given in the *Veterinary Record* at page 775. Dr. Usher is not a Fellow of this College, but I assume (from the otherwise meaningless insertion of the addition (Edin.) after the title) that the letters "F.R.S. Edin." were intended.—Yours faithfully, Fred Bullock, Secretary and Registrar.

Royal College of Veterinary Surgeons,
10 Red Lion Square, London, W.C.1,
15*th September*, 1924.

The Editor begs to acknowledge the receipt of the following:—

Communication from Mr. R. W. Lewis.

Report of Meeting of the Eastern Counties Division, from Mr. W. Shiplev, Hon. Sec.

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